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Multivariate analysis of surface water quality of the Bay of Cartagena (Colombia) period 2001-2017

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Abstract : Cartagena Bay is directly affected by wastewater discharges from the city of Cartagena de Indias, its industrial zone and the mouth of the Magdalena River (Dique Canal). Multivariate statistical analyzes such as cluster analysis and principal components were used to evaluate the spatial variation of water quality at thirteen points of the bay during the period 2001- 2016. The results were compared with national water quality guidelines for secondary contact water. It showed that Dique Canal impacted in the concentration of solids in the whole bay and produced outliers out of the acceptable range for this parameter. Wastewater from residential areas, boats, Dique Canal and industrial area contaminate the bay with faecal coliforms which may become a public health problem due the high levels of this parameter (eg 19,000 NMP in residential areas). Salinity is below recommended values for the conservation of existing coral species in the bay. In addition, the phosphorus concentration is above the limit to avoid eutrophication of the water body. Three factors were identified as responsible for the data structure, explaining 88.1% of the total variance. The first factor is due to nutrients parameters explaining 56,5% of the total variance. The second and third factors are, respectively, the biochemical (19,91%) and anthropogenic (11,67%). The clustering procedure highlighted three different groups in which the sampling sites have similar characteristics and pollution levels. Cluster one and two have moderate pollution levels, but cluster three is a highly polluted one.

Keywords : Multivariate statistical techniques, Spatial variation, Temporal variation, Water quality.

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